THE WESTERN AUSTRALIAN
NATURALIST

Vol. 12 August 17, 1972 No. 4

TROPICAL SEEDS AND FRUITS WASHED UP ON THE SOUTH-WEST COAST OF WESTERN AUSTRALIA

By KEVIN F. KENNEALLY, Botany Department, University of Western Australia, Nedlands

INTRODUCTION

For many years, the Western Australian Herbarium has acquired seeds and fruits of tropical plants cast up on beaches between Perth and Albany. These collections have recently been identified for the Western Australian Herbarium and the Herbarium of the Botany Department, University of Western Australia by the Royal Botanic Gardens, Kew and the Rijksherbarium, Leiden.

Unfortunately, most of the specimens lack precise collection data in as much that specific localities of collection are not given. Sutherland (1965) commenting on the shore drift of pumice on southern Australian and Tasmanian beaches stated that: "the reported date of finding of stranded pumice is not necessarily the date of arrival". This criterion also applies to the reported finding of drift seeds.

It is therefore hoped, that this paper will stimulate collectors to forward seeds to the author at the above address (giving the locality and date of collection) so that a more exact distribution pattern may emerge.

The drifted seeds which have been identified include *Nypa fruticans, Pangium edule, Entada* sp., *Caesalpinia bonduc, Caesalpinia japonica, Xylocarpus moluccensis, Sapium indicum, Heritiera littoralis, Heritiera globosa, Trapa natans* f. *bicornis* and *Cerbera odollam.*

The seeds cited below are housed in the carpological collections of the Western Australian Herbarium (PERTH), or in the Herbarium of the Botany Department, University of Western Australia (UWA).

ARECACEAE subfam. NYPOIDEAE

Nypa fruticans van Wurmb. Plate 1A

A palm of the littoral of tidal rivers. Distribution: East India to Northern Australia. Fruits are shining, dark brown to black, with an outer husk of fibrous tissue.

Seeds are used by the Chinese for sweet-meat. Immature fruits are boiled with sugar and used as preserves.

FLACOURTIACEAE

Pangium edule Reinw. Plate 1B & C

A tree mainly of the primary and secondary rain forests, river banks, teak forests and more rarely of tropical sea beaches. Distribution: throughout Melanesia, Micronesia, Malaysia, Lesser Sunda Is., South Molucceas and New Guinea.

The seeds are boiled, cut up and macerated in water then eaten. Fresh seeds and oil contain a poisonous glucoside breaking down and producing prussic acid, used in Indonesia in the preparation of dart poison (Sleumer, 1954).

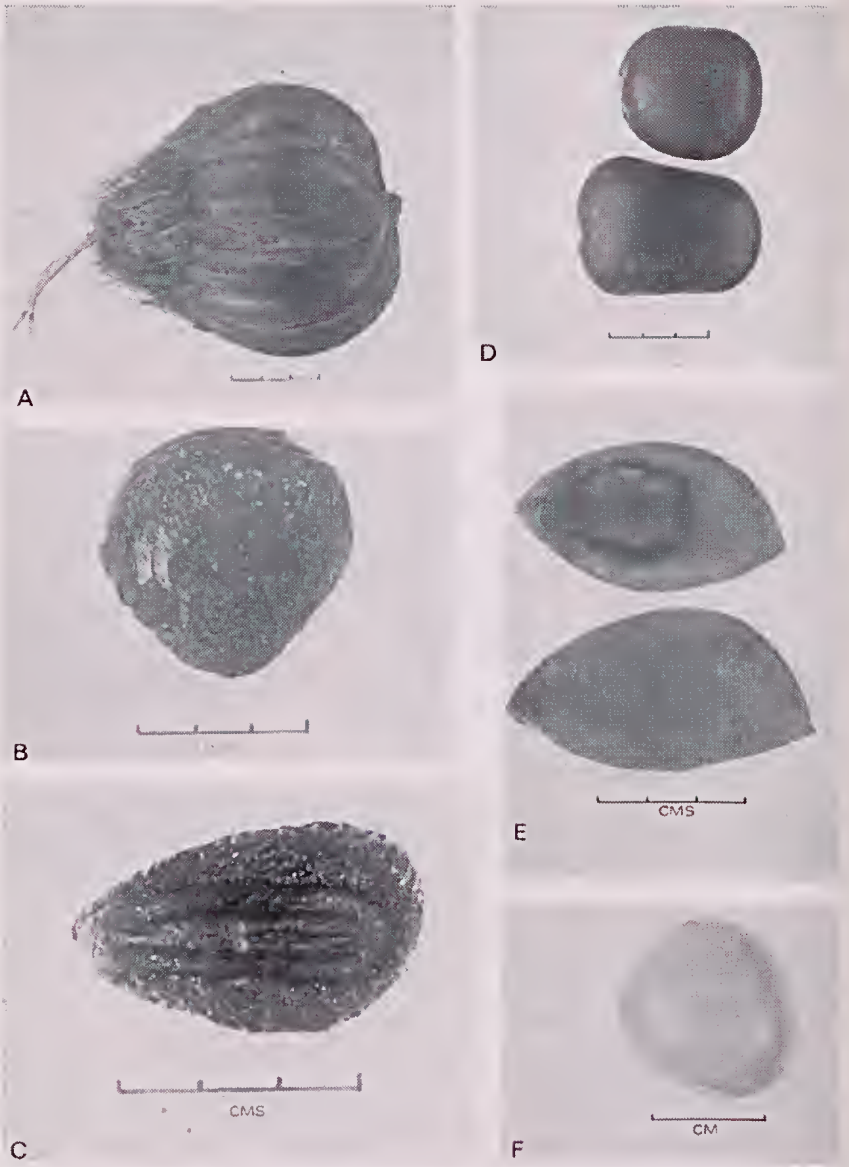

Plate 1.—Tropical drift seeds and fruits. (A) *Nypa fruticans;* (B) *Pangium edule;* (C) *Pangium edule*-view of hilar groove; (D) *Entada* sp.; (E) *Caesalpinia japonica;* (F) *Caesalpinia bonduc.*

MIMOSACEAE

Entada sp. (Sword Bean, Sea Bean, Fairies' Kidneys) Plate 1D

The genus *Entada* consists of several species of woody climbers (lianes) which are famous for the wide dispersal of their seeds by ocean drift. However specific identification cannot be made on the seeds alone (Brennan, 1955). Distribution: Malay Peninsula, Java, Sumatra, Philippines, Northern Australia, Thailand, Ceylon and Fiji.

These plants bear pods up to 1m long and 10cm wide containing seeds which are dark brown, polished and hard. Various uses for the seeds have been reported. The most common use is in the making of trinkets and small receptaeles, whilst some natives use them in the washing of their hair. The use of the seed extract as a contraceptive by the Australian Aborigines, has been recorded by de Laszlo and Henshaw (1954). The seeds have also been recorded as being slightly toxie and used as an emetie (Watt & Breyer-Brandwijk, 1962).

CAESALPINIACEAE

Caesalpinia bonduc (L.) Roxb. (Nicker Nuts) Plate 1F

A thorny, scrambling bush bearing pods containing one or two pale yellow seeds. Distribution: India, Ceylon, Malay Peninsula, Java, Borneo, Philippines, Cook I., Norfolk I., Polynesia, Tropical Africa, Florida, West Indies, Panama and New Grenada.

Seeds of this speeies have been reported drifted by oeean eurrents on to the South Afriean eoast (Muir, 1934). The most eommon use of the seeds by natives is in the making of amulets and in the treatment of diarrhoea.

Caesalpinia japonica Sieb. & Zucc. Plate 1E

A liane of the mangrove formation but more rarely on littoral roeks or sandy beaches. Distrihution: Himalayas, Ceylon, Java, Malay Is., China and Japan.

MELIACEAE

Xylocarpus moluccensis (Lam.) Roem. Plate 2A

A tree of tidal forests and mangrove swamps of tropieal rivers and sea eoasts. Ridley (1930) said of this plant: "no drift seeds are more eonspieuous or abundant in the tropieal Asiatie seas". The seeds which are borne inside a brown eapsule 8-15 em in diameter float for many months. Distribution: Seyehelles, Andaman Is., Thailand, Malay Peninsula, Malay Is., Cocos I., Northern Australia and Polynesia.

Watt & Breyer-Brandwijk (1962) report that the fluid whieh exudes from the unripe fruit is drunk as an aphrodisiae.

EUPHORBIACEAE

Sapium indicum Willd. (Mock Willow) Plate 2D

A tall willow-like tree very common along tidal ereeks, rivers, streams and in fields near the sea. Distribution: India and Malaysia.

The seed ean be eaten when ripe but the latex which surrounds the seed is eaustie.

STERCULIACEAE

Heritiera littoralis Aiton (Puzzle Seed) Plate 2B

A maritime tree widely distributed in mangrove, tidal swamps and along sea beaehes. Distribution: Zanzibar, Mascarene Is., India, Little Cocos, Malay Peninsula, Northern Australia, Polynesia and Fiji.

The seed is shaped "rather like the hull of a broad-beamed boat, with a small keel" (Holttum, 1969).

Heritiera globosa Kosterm Plate 2C

This speeies is reeorded for Borneo but little other information is available.

TRAPACEAE

Trapa natans L. f. *bicornis* (Osbeck) Gluck (Water Chestnuts, Jesuit's Nut, Water Caltrop) Plate 2F

A native of Asia introdueed into Malaysia probably by the Chinese. The fat-eontaining kernels of *Trapa* are highly nutritious and in several parts of Asia it is a staple food. The plant is eultivated by the Chinese and other natives for the fruit whieh is mainly dispersed by river and flood.

APOCYNACEAE

Cerbera odollam Gaertn. Plate 2E

A tree or large shrub of the littoral of tidal rivers. Distribution: Madagascar, Seychelles, India, Ceylon, Andamans, Hong Kong, Taiwan, Malay Peninsula and Christmas Island. Fruits have been reported drifted up on the beaches of Cocos I., Northern Australia and Pitcairn Island (Ridley, 1930).

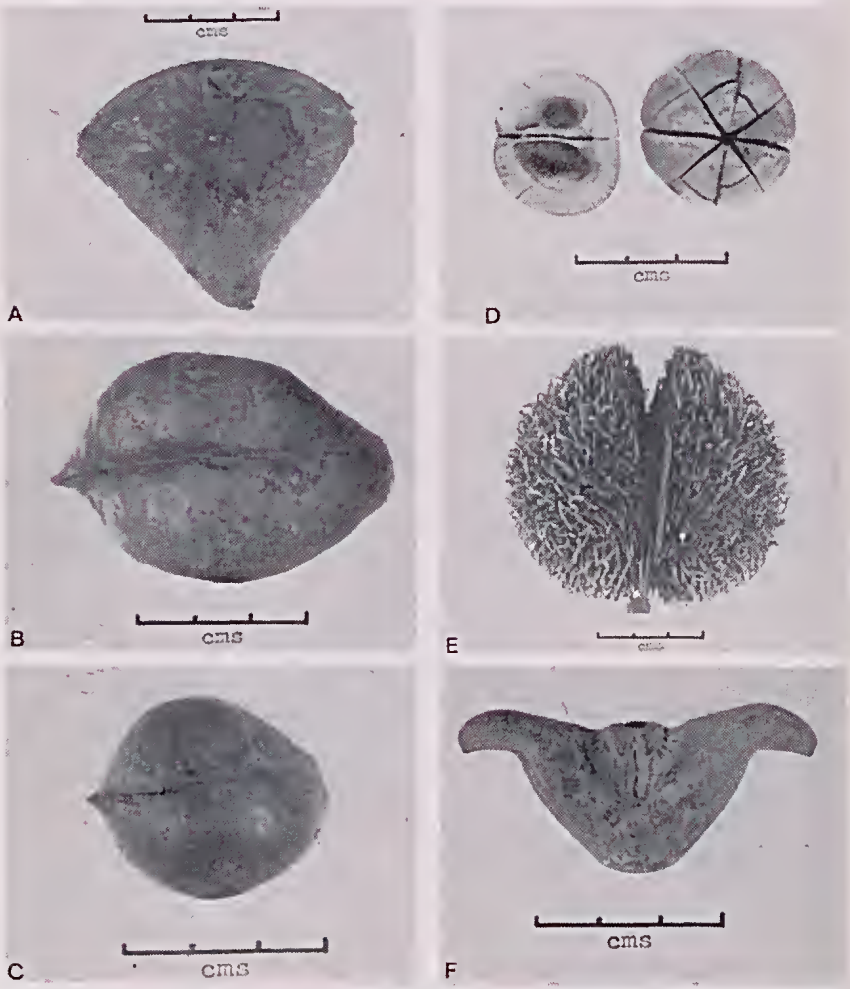

Plate 2.—Tropical drift seeds and fruits. (A) *Xylocarpus moluccensis;* (B) *Heritiera littoralis;* (C) *Heritiera globosa;* (D) *Sapium indicum;* (E) *Cerbera odollam;* (F) *Trapa natans* f. *bicornis.*

METHODS OF BUOYANCY

Buoyancy of seeds mostly depends on trapped air within the seed or fruit, although other adaptations are present in some water-borne seeds. The buoyancy of *Entada* sp. is said to be due to the shrinking and bending outwards of the cotyledons during shrinking and hardening, leaving a large central cavity in the seed (Ridley, 1930). In *Nypa* the buoyancy is due as in the coconut to the light husk, while in *Heritiera* sp. it is due to the light fibrous coat of the carpel wall.

The distance which sea-borne seeds can travel and remain viable is difficult to determine, for apart from normal physiological ageing and the effect of salt water, they are liable to incur injuries such as result from boring by marine molluscs.

DRIFT SEEDS AND OCEAN SURFACE CURRENTS

The importance of ocean currents as a dispersal agent has been well documented (Ridley, 1930; Guppy, 1906, 1917). Sea carried tropical seeds have been reported on the beaches in south east Africa (Muir, 1934, 1937) and the Ninety Mile Beach on the west coast of Auckland, New Zealand (Mason, 1961).

Two seeds of *Caesalpinia bonduc* found on the shores of South Australia were considered by Guppy (1917) to have been transported not from northern Queensland where this species occurs, but more likely from tropical East Africa or Madagascar by the Mozambique, Agulhus and West Wind Drift surface currents. This brings us to the problem of which

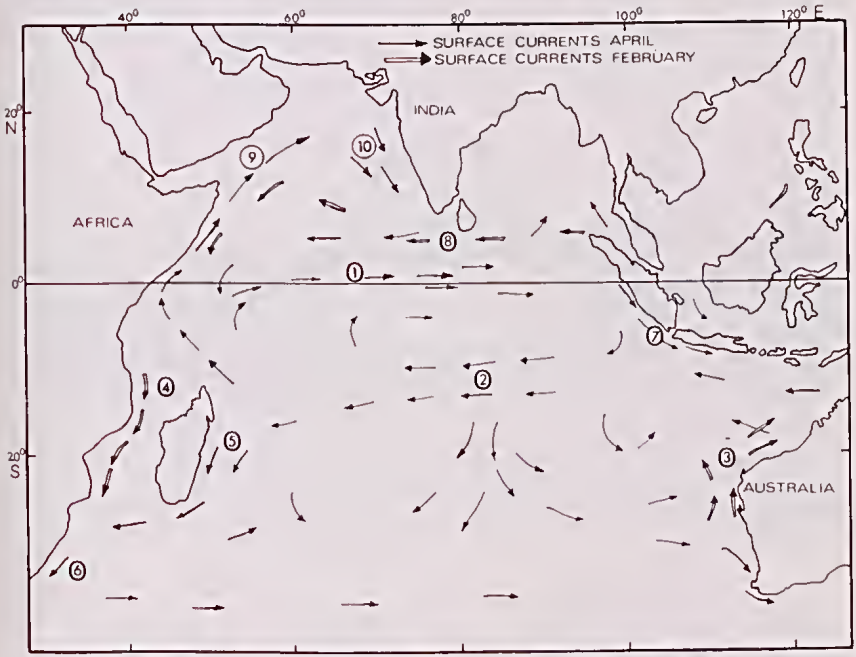

Fig. 1.—Sea surface currents in the Indian Ocean. Legend: 1 Counter Current; 2 South Equatorial Current; 3 West Australian Current; 4 Mozambique Current; 5 Madagascar Current; 6 Agulhus Current; 7 West Sumatra-Java Current; 8 North Equatorial Current; 9 Somali Current; 10 South West Monsoon Current.

ocean currents are responsible for the deposition of seeds on our beaches. Figure 1 shows the principal surface currents in the Indian Ocean for winter and summer. In the southern Indian Ocean the principal surface currents in the summer are the Counter Current, South Equatorial, West Australian, Mozambique, Madagascar, Agulhus and Sumatra-Java; whilst in the winter the surface currents are the South Equatorial, Mozambique and Madagascar. In the northern Indian Ocean the principal surface current in the summer is the North Equatorial; whilst in the winter the Somali and south-west Monsoon currents prevail (Rochford, 1967).

Currents in the Indian Ocean are outstanding for both their speed and concentration (Neumann, 1968). Seeds of *Xylocarpus moluccensis* have

reached Cocos Island from Java, a distance of 700 miles, in seven to eight weeks (Ridley, 1930).

Seeds are possibly picked up by the South Equatorial Current after being carried out to sea by flooded tropical rivers during the summer monsoons. From here they would then be carried by the Mozambique, Agulhus and West Wind Drift (no doubt collecting seeds from the East African coast) finally being washed up on our southern beaches.

Drift specimens of tropical seeds occur frequently on the beaches of the south-west coast coinciding with the area where, according to Defant (1961), the West Wind Drift first meets the Australian coast. Seeds of *Caesalpinia* sp. have been collected from Hamelin Bay (PERTH); Cowaramup Bay (PERTH) and those of *Entada* sp. from Torbay (PERTH); Yallingup (PERTH); West Cape Howe, G. Braithwaite (UWA); Quarram Beach W. of Denmark, E. Egerton-Warburton (UWA) and 2 miles south of Donnelly River mouth, G. Keighery (UWA).

Plate 3.—*Durvillea antarctica* (A) T.S. of blade showing honeycomb structure of the air chambers; (B) A fragment of the leathery blade.

Further evidence of plant drift material correlated with the West Wind Drift is the frequent occurrence of fragments of the thalli of the massive brown alga, *Durvillea antarctica* (Cham.) Hariot, observed and collected on many of the beaches west of Albany and more rarely on the beaches near Perth. This species has never been found growing on the Australian coast (Guiler, 1960). The earliest drift record of this alga for the Western Australian coast appears to be a collection made in 1947 by Miss A. Baird at Nornalup, seventy miles west of Albany (see Moore & Cribb, 1952).

D. antarctica occurs from Valparaiso to Cape Horn, Straits of Magellan, Falkland Islands and is abundant in suitable habitats around the coast of New Zealand and its outlying islands (Moore & Cribb, 1952). The nearest source to the Western Australian coast is Kerguelen, more than five thousand miles away. The alga can be readily identified by the leathery blade, occupied by a series of air chambers which give it a 'honeycomb' effect (Plate 3).

Another example of plant drift from South America was the discovery of a 75 foot softwood tree washed ashore between Two People Bay and

Betty Bay (about 30 miles west of Albany) in 1961. This specimen was identified by CSIRO as a South American species of *Nothofagus (Albany Advertiser,* June 16, 1961).

Specimens of *Entada* sp. collected from Trigg Island (PERTH); City Beach (PERTH); Cottesloe Beach (PERTH) and Cockburn Sound (PERTH), have most likely been swept up the coast by the Western Australian Current.

Early evidence to support the branching north of the Western Australian Current as it approaches Cape Leeuwin was first documented by Schott (1897) and cited by Guppy (1917). Schott cites the case of the loss of the ship *Blue Jacket,* that burned between the Falkland Islands and Cape Horn in latitude 53°S. and longitude 60°W. in March 1869, and how its figurehead was recovered on the shores of Rottnest by Aborigines. The discovery of the figurehead is well documented by the newspapers of the day, and a full description made by the Port Pilot of Fremantle (G. A. Forsyth) was published in the *Inquirer and Commercial News* of December 13, 1871. The subsequent recognition in New Zealand that the figurehead belonged to the *Blue Jacket* a ship of 1200 tons registry, was announced by the *Inquirer and Commercial News* (February, 1872) and the Melbourne *Argus* (March 1872).

The part man plays in the arrival of seeds on the Western Australian coast has still to be assessed. There is evidence to suggest that some seeds found have been transported to the coast by ship and then thrown overboard. A large number of *Nypa fruticans* were observed on the wharf at Fremantle Harbour in April, 1971 (K. Thies, pers. comm.), but enquiries with harbour and quarantine authorities failed to trace how they had come to be there. Soon after this sighting, large numbers were collected from Minim Cove up the river from the harbour, N. Marchant (PERTH); and from drift at Leighton Beach north of Fremantle, K. F. Kenneally and S. Paust (UWA). All of these specimens were remarkably 'fresh' the exocarp being smooth and entire showing little damage from immersion. In many seeds germination had occurred and the plumule was still green. As seedling development in *Nypa* is viviparous (Tomlinson, 1971) it is unlikely that the germinating fruits could have prised themselves from the infructescence, drifted from the tropics and be washed ashore at Fremantle in such a 'fresh' condition.

The increasing mobility of man and his influence as an agent of dispersal, complicated by the economic importance placed on many of these fruits and seeds by native peoples, contributes to their distribution.

Although seed records give some evidence of surface drift patterns, the most useful evidence is obtained by the experimental method of release and recovery of drift cards.

GERMINATION OF SEEDS

The natural germination and survival of tropical seeds on southern Western Australian beaches has never been reported. However seeds of *Entada* sp. found on a local beach have been said to have germinated in cultivation (R. D. Royce, pers. comm.). The germination of *Entada* sp. in cultivation has been recorded for New Zealand (Mason, 1961).

It is very unlikely that tropical seeds would ever establish themselves on southern beaches owing to our temperate climate and the exposed shoreline with the dune complex directly behind it (Plate 4).

ACKNOWLEDGEMENTS

The writer wishes to extend his thanks to Mr R. D. Royce, Curator and Mr P. G. Wilson, Botanist, Western Australian Herbarium; Professor C. G. G. J. van Steenis, Director, Rijksherbarium, Leiden; and the Director, Royal Botanic Gardens, Kew, for their generous assistance.

Special thanks are extended to the Braithwaite family of Mount Barker for their generous hospitality whilst collecting on the south coast and to their son Gregory for his assistance in the field.

I wish to also thank Mr M. Mitchell for his advice on photography and Mr G. G. Smith for his help with the checking of the manuscript.

Plate 4.—Quarram Beach west of Denmark, accessible only by 4-wheel drive vehicle. Two seeds of *Entada* were found on this beach.

REFERENCES

Brenan, J. P. M. 1955. Notes on the Mimosoideae: 1. *Kew Bulletin.* Her Majesty's Stationery Office, Lond.

Defant, A. 1961. *Physical oceanography.* Vol. 1. Pergamon Press, Lond.

de Laszlo, H. & Henshaw, P. S. 1954. Plant materials used by primitive people. *Science,* 119: 626-631.

Guiler, E. R. 1960. The intertidal zone-forming species on rocky shores of the east Australian coast. *J. Ecol.,* 48: 1-28.

Guppy, H. B. 1906. *Observations of a naturalist in the Pacific.* Vol. 2, Seed dispersal. Macmillan & Co., Lond.

Guppy, H. B. 1917. *Plants seeds and currents in the West Indies and Azores.* Williams & Norgate, London.

Holttum, R. E. 1969. *Plant life in Malaya.* Longman, Malaysia.

Mason, R. 1961. Dispersal of tropical seeds by ocean currents. *Nature,* 191; 408-409.

Moore, L. B. & Cribb, A. B. 1952. The brown alga *Durvillea antarctica* in Australian waters. *Nature,* 169; 1100-1101.

Muir, J. 1934. The correlation of arrival sites of alien seeds with ocean currents. *S. African Geog. Journ.,* 17; 13-18.

Muir, J. 1937. The seed drift of South Africa. *Botanical Survey Memoir* No. 16. Govt. Printer.

Neumann, G. 1968. *Ocean currents.* Elsevier Publishing Co., New York.

Ridley, H. N. 1930. *The dispersal of plants throughout the world.* L. Reeve & Co., Ashford, Kent.

Rochford, D. J. 1967. Phosphate levels of the major surface currents of the Indian Ocean. *Aust. J. Mar. Freshwater Res.,* 18; 1-22.

Schott, G. 1897. Die flaschenposten der Deutschen Seewarte, *Archiv. der Deutschen Seewarte,* xx.

Sleumer, H. 1954. Flacourtiaceae, in *Flora Malesiana,* vol. 5. C. G. G. J. van Steenis (ed.) P. Noordhoff Ltd. Netherlands.

Sutherland, F. L. 1965. Dispersal of pumice on southern Australian shores. *Nature,* 207; 1332-1335.

Tomlinson, P. B. 1971. The shoot apex and its dichotomous branching in the *Nypa* Palm. *Ann. Bot.,* 35; 865-79.

Watt, J. M. & Breyer-Brandwijk, M. G. 1962. *Medicinal and poisonous plants of southern and eastern Africa.* E. & S. Livingstone Ltd., Edinburgh & Lond.